PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project	
Idaho Supplementation Studies	
BPA project number	**8909800**
Contract renewal date (mm/yyyy)	**01/2000**
Multiple actions? (indicate Yes or No)	**Yes**
Business name of agency, institution or organization requesting funding	
Idaho Department of Fish and Game	
Business acronym (if appropriate)	**IDFG**
Proposal contact person or principal investigator:	
Name	**Peter F. Hassemer**
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City, ST Zip	**Nampa, ID 83686**
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NPPC Program Measure Number(s) which this project addresses	
7.3B.2, 7.0A, 7.1B.1, 7.1C.3, 7.2A	
FWS/NMFS Biological Opinion Number(s) which this project addresses	
ESA Section 10 permitted, Federal Land Management NEPA compliance	
Other planning document references	
4.5C, 4.1, 4.1B, 4.2 - NMFS draft Snake River Salmon Recovery Plan, Wy Kan Ush Me Wa Kush Wit 5B page 14-23	
Short description	
Evaluate various supplementation strategies for maintaining and rebuilding spring/summer chinook populations in idaho. Develop recommendations for the use of supplementation to rebuild naturally spawning populations.	
Target species	
Snake River spring/summer chinook salmon	

Section 2. Sorting and evaluation

Subbasin
Salmon River, Clearwater River

Evaluation Process Sort

	CBFWA caucus		CBFWA eval. process		ISRP project type
	X one or more caucus		If your project fits either of these processes, X one or both		X one or more categories
X	Anadromous fish	X	Multi-year (milestone-based evaluation)		Watershed councils/model watersheds
	Resident Fish		Watershed project eval.		Information dissemination

	Wildlife			Operation & maintenance
				New construction
			X	Research & monitoring
				Implementation & mgmt
				Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description
20545	Idaho Supplementation Studies - Umbrella
8909800	Idaho Supplementation Studies - IDFG
8909801	Idaho Supplementation Studies - USFWS
8909802	Idaho Supplementation Studies - NPT
8909803	Idaho Supplementation Studies - SBT

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
9005500	Steelhead Supplementation Studies	Reciprocal transfer of data/coordination
9107300	Idaho Natural Production Monitoring and Evaluation	Reciprocal transfer of data/coordination
8335000	Nez Perce Tribal Hatchery- O&M	Reciprocal transfer of data/coordination
9405000	Salmon River Habitat Enhancement - O&M, M&E	Reciprocal transfer of data/coordination
9705700	Salmon River Production Program	Reciprocal transfer of data/coordination
9703000	Monitor Listed Stock Adult Chinook Salmon Escapement	Reciprocal transfer of data/coordination
9604300	Johnson Creek Artificial Propagation Enhancement- O&M, M&E	Reciprocal transfer of data/coordination
9102800	Monitoring Smolt Migration of Wild Snake River Spring/Summer Chinook Salmon	Reciprocal transfer of data/coordination

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?
1991	Identified study areas, brood stocks, facilities to be used.	Yes. Began preliminary baseline data collection on treatment and control streams, target stock history, genetic sampling.
1991	Brood stock development.	Initiated marking and development of local brood stocks to provide future releases.
1992	Begin supplementation and monitoring of treatment streams, and monitoring of control streams.	Yes. Initiated parr and smolt releases for treatment streams. Used existing hatchery brood stocks for first generation supplementation.
1996	Small scale investigations into chinook salmon supplementation strategies and techniques: 1992-1994. Technical Report.	Yes. Completed small scale studies to monitor behavioral interactions between natural and hatchery fish.

	Perry, C.A. and T.C. Bjornn.	
1997	First generation returns, a known brood stock for supplementation is established.	Yes. Brood stock selection begins with local stocks of known components.
1998	Five-year Report (1991-1996) in progress.	Yes. Summarize baseline data, review methodology, continue supplementation of treatment streams and monitoring of control streams, continue monitoring of juvenile survival and abundance, and monitoring of adult returns.

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Monitor and evaluate the effects of supplementation on parr, pre smolt and smolt numbers, and spawning escapements of naturally produced salmon.	a	Continue to implement "standardized" spawning, rearing, marking, and release protocols.
1		b	Differentially mark all hatchery supplementation and general production fish released in or nearby the study streams.
1		c	PIT tag a minimum of 700 hatchery supplementation and general production fish released in or nearby the study streams.
1		d	Release various life stages of chinook salmon. Determine fish numbers for each life stage based on existing natural production and natural rearing capacity.
1		e	Estimate late summer parr densities from snorkel surveys.
1		f	PIT tag a minimum of 700 naturally produced parr from each treatment and control stream to estimate smolt production and survival.
1		g	Use existing weirs to collect, mark (PIT tag), and enumerate emigrating fish and to identify and enumerate returning adults.
1		h	Compare natural production of supplemented populations to unsupplemented populations and baseline data.
2	Monitor and evaluate changes in natural productivity and genetic composition of target and adjacent populations following supplementation.	a	Monitor productivity and genetic indices from supplemented populations and compare baseline and controls. Productivity characteristics will be evaluated as a function of density or percent carrying capacity to minimize density dependent effects confounding treatment effects.
2		b	Monitor straying of hatchery supplementation fish into adjacent and control streams by weirs and carcass surveys.
2		c	Determine spawner to recruitment relationship based on determined production and productivity indices (parr and smolt numbers, adult escapements, survival, eggs/spawner etc.).
2		d	Predict population viability based on spawner

Obj 1,2,3	Objective	Task a,b,c	Task
			to recruitment relationship to determine if the population will maintain itself through time in the absence of additional supplementation.
3	Determine which supplementation strategies (brood stock and release stage) provide the quickest and highest response in natural production without adverse effects on productivity.	a	Monitor and evaluate natural production (pre smolt, Smolt and adult numbers) and productivity (survival, life stage characteristics, pathogens, straying, genetic composition) of supplemented populations and compare to baseline and controls.
3		b	Use local brood stocks with known natural component from the target population during the second generation of supplementation.
3		c	Compare natural production and productivity indices of supplemented populations using existing hatchery brood stocks (first generation) to populations using locally developed brood stocks (second generation).
3		d	Compare natural production and productivity indices among supplemented populations using parr, pre smolt, and smolt release strategies.
4	Develop supplementation recommendations. (Long term).	a	Guidelines and recommendations will be developed addressing risks and benefits of supplementation (augmentation and restoration) in general and specific supplementation strategies (brood stock and release stage).

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measureable biological objective(s)	Milestone	FY2000 Cost %
1	05/1992	12/2007	Evaluation of supplementation effects on numbers of presmolt and smolt, and spawning excapements of naturally produced salmon.	X	31
2	05/1992	12/2007	Evaluate increases or decreases in number of naturally produced salmon. Evaluate genetic composition of target and adjacent populations following supplementation.	X	31
3	05/1992	12/2007	Determine which brood stock and release stage result in the quickest and highest (if any) increase in natural production, without adversely effecting the productivity.	X	31
4	01/1999	12/2007	Supplementation recommendations completed in final study report.	X	7
				Total	100

Schedule constraints The continued decline of spring/summer chinook salmon returning to Idaho result in insufficient adult returns to provide target supplementation treatments.
Completion date 2007

Section 5. Budget

FY99 project budget (BPA obligated):	**$906,499**

FY2000 budget by line item

Item	Note	% of total	FY2000 ($)
Personnel	5.17 FTE permanent, 9.83 FTE temp.	41.5	404,222
Fringe benefits	35% of salary	14.5	141,478
Supplies, materials, non-expendable property	Misc. Supplies for field and office operations	1.4	14,000
Operations & maintenance	Field and Office	12.8	124,401
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	Replace 2 vehicles with >130,000 miles; replace 2 field computers; wand-detector for CWTd fish	6.0	58,800
NEPA costs			
Construction-related support			
PIT tags	# of tags: 18,500	5.5	53,650
Travel	Project Coordination and meeting attendance	0.7	6,500
Indirect costs	Set by IDFG, estimated to be 23% of all costs except capital acquisitions.	17.6	171,178
Subcontractor			
Other			
	TOTAL BPA REQUESTED BUDGET		974,229

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
		Total project cost (including BPA portion)	

Outyear costs

	FY2001	FY02	FY03	FY04
Total budget	975,000	975,000	985,000	990,000

Section 6. References

Watershed?	Reference
	Northwest Power Planning Council (NPPC). 1994. Columbia River Basin Fish and Wildlife

	Program. Portland, Oregon.
	Regional Assessment of Supplementation Project (RASP). 1991. Draft status report for review and comment. Prepared for Bonneville Power Administration PJSP, Portland, Oregon.
	ISS Project Reports
	Bowles, E. and E. Leitzinger, 1991. Salmon Supplementation Studies in Idaho Rivers. Experimental Design to the U.S. Department of Energy, Bonneville Power Administration. Project No. 89-098. Contract No. DE-B179-89BP01466.
	Salmon Supplementation Studies in Idaho Rivers- Five year summary report. (In progress 1999).
	Peery, C.A., and T.C. Bjornn. 1996. Small-scale investigations into chinook salmon supplementation strategies and techniques: 1992-1994. Technical Reports 96-3 ICFWRU, University of Idaho. IDFG and BPA, Portland, Oregon.
	IDFG Reports
	Leitzinger, E.J., K. Plaster, P. Hassemer, and P. Sankovich. 1996. Idaho supplementation studies annual progress report 1993. Idaho Department of Fish and Game annual report to U.S. Department of Energy-Bonneville Power Administration. Portland, Oregon.
	Leitzinger, E.J., K. Plaster, and E. Bowles. 1993. Idaho supplementation studies annual report 1991-1992. Fisheries Research Section, Idaho Department of Fish and Game annual report to U.S. Department of Energy-Bonneville Power Administration, Portland, Oregon.
	Nemeth, D., K. Plaster, K. Apperson, J. Brostrom, T. Curet, and E. Brown. 1996. Idaho supplementation studies annual report 1994. Idaho Department of Fish and Game annual report to U.S. Department of Energy-Bonneville Power Administration, Portland, Oregon.
	Nez Perce Reports
	Arnsberg, B.D. 1993. Salmon Supplementation Studies in Idaho Rivers. Annual work summary for 1992. U.S. Department of Energy-Bonneville Power Administration. Portland, Oregon.
	Hesse, J.A., and B.D. Arnsberg. 1994. Salmon Supplementation Studies in Idaho Rivers. Annual Report- 1993. U.S. Department of Energy-Bonneville Power Administration. Portland, Oregon.
	Hesse, J.A., P.J. Cleary, and B.D. Arnsberg. 1995. Salmon Supplementation Studies in Idaho Rivers. Annual Report-1994. U.S. Department of Energy-Bonneville Power Administration. Portland,Oregon.
	Sho-Ban Reports
	Keith, R.M., M. Rowe, C.A. Reighn, J.Honena, and T. Trahant. 1996. Salmon Supplementation Studies in Idaho Rivers-Annual Report 1995. U.S. Department of Energy-Bonneville Power Administration. Portland, Oregon.
	USFWS Reports
	Rockhold, E.A., R.B. Roseberg, and J.M. Olson. 1997. Idaho Supplementation Studies Pete King and Clear creeks progress report 1991-1993. U.S. Department of Energy-Bonneville Power Administration. Portland, Oregon.

PART II - NARRATIVE

Section 7. Abstract

The goal of the Idaho Supplementation Studies Project is to evaluate the usefulness of supplementation as a recovery/restoration strategy for depressed stocks of spring and summer chinook salmon in Idaho. The project is a multi-agency effort, covering 31 streams throughout the Salmon River and Clearwater River basins, working to help define the potential role of chinook salmon supplementation in managing Idaho's natural spring and summer chinook populations, and identify genetic and ecological impacts to existing natural populations. The ISS experimental design is split into three main approaches: (1) Large scale population production and productivity studies designed to provide Snake River basin wide inferences. (2) Using study streams to evaluate specific supplementation programs. (3) Small scale studies designed to evaluate specific hypotheses. Approaches one and two measure population responses to supplementation and are long term studies. Approach three determines specific impacts of supplementation such as competition, dispersal, and behavior; and are short term studies conducted in "controlled" environments. We expect this research to demonstrate the best methods for

supplementing existing natural populations of chinook salmon and re-establishing natural populations in streams where chinook salmon have become extirpated. We expect supplementation effects and recommendations to be different for each stream. The study design called for a minimum of 15 years (three generations) of research (Bowles and Leitzinger 1991). Sampling was initiated in 1991 and implementation began in 1992. The supplementation effects will be monitored and evaluated by comparing juvenile production and survival, fecundity, age structure, and genetic structure and variability in treatment and control streams of similar ecological parameters.

Section 8. Project description

a. Technical and/or scientific background

A detailed technical/scientific background is covered in the Idaho Supplementation Studies (ISS) umbrella proposal. Due to the large geographic scope of this study, study streams were partitioned among four resource management entities for implementation. These include Idaho Department of Fish and Game, Nez Perce Tribe, Shoshone-Bannock Tribe, and the U.S. Fish and Wildlife Service- Idaho Fishery Resource Office. Allocations were based on interest, integration with ongoing programs, cost efficiency, logistics and, to a lesser extent, relative equity. Approximately one-half of the study will be implemented by Idaho Department of Fish and Game through the ISS contract with BPA. The Nez Perce Tribe and Shoshone-Bannock Tribe have similar commitments to ISS, each comprising approximately 20% of the study. Both of these components rely heavily on integration of existing or proposed tribal programs. The Idaho Department of Fish and Game is the lead agency regarding project development, coordination, and implementation.

b. Rationale and significance to Regional Programs

The Northwest Power Planning Council (NPPC) has called "for immediate efforts to gather data on wild and naturally spawning stocks, review impacts of the existing hatchery system and coordinate supplementation activities" to achieve its goal of doubling anadromous fish runs in the Columbia Basin as addressed in the Columbia Basin Fish and Wildlife Program (NPPC 1994). The research goals of the Idaho Supplementation Studies are to: (1) Assess the use of hatchery chinook salmon to increase natural populations of spring and summer chinook in the Salmon and Clearwater River drainages; (2) Evaluate the genetic and ecological impacts of hatchery chinook salmon on naturally reproducing chinook populations. The relationships between FWP (1994) and ISS research objectives are reviewed below:

FWP Section 7.3B.2 - ISS Research Objectives 1 through 3 (Implementation Phase): Implement the high priority supplementation including monitoring and evaluation, among others.

FWP Section 7.0A - ISS Research Objectives 1 and 3: Identify which supplementation strategies (brood stock and release stage) will be most affective in increasing natural production without adverse effects on productivity.

FWP Section 7.1B.1 - ISS Research Objective 2: Monitor and evaluate changes in productivity and genetic composition of target and adjacent populations following supplementation.

FWP Section 7.1C.3 - ISS Research Objective 2: To establish a baseline profile for evaluation and monitoring, we will include a genetic profile analysis for treatment and control streams.

FWP Section 7.2A - ISS Research Objectives 1 through 4: Based on the results of each of the objectives we expect to document which methods are best for supplementing existing, naturally reproducing populations of chinook salmon and re-establishing naturally producing populations in streams where they have been extirpated.

Supplementation in Idaho parallels basin wide needs and concerns as well as addressing unique concerns for upriver stocks. There are supplementation projects ongoing in Washington, Oregon, and Idaho. We have reviewed these projects to enhance coordination and integration with ISS and to avoid unnecessary duplication of effort. A major contributor in this effort has been our participation in the Regional Assessment of Supplementation Project (RASP). The RASP has focused on providing an overview of ongoing and planned supplementation activities; identifying critical uncertainties, and how to technically address them; providing the framework for a "global" experimental design; and developing a model to identify realistic benefits and risks of supplementation (RASP 1991). There are also numerous supportive research or monitoring projects in Idaho that are not studying

supplementation but will provide valuable data for ISS that are carried out by IDFG, Sho-Ban Tribes, Nez Perce Tribe, USFS, NMFS, ICFWRU. Supportive information includes parr density estimates, redd counts, habitat characteristics, spawning distribution and behavior, fish marking, rearing and density effects, and pathogen screening.

c. Relationships to other projects

ISS is a cooperative effort between the Idaho Department of Fish and Game, U.S. Fish and Wildlife Service, the Nez Perce Tribe, and the Shoshone-Bannock Tribes. Each cooperating agency has the responsibility for investigations of different streams within Idaho. All cooperators meet together to plan project activities and discuss adaptive changes necessary to maintain project relevancy and effectiveness.

Each ISS cooperator completes requirements for the National Environmental Policy Act (NEPA) with land management agencies where project activities occur on public land. ESA section 10 permits are also acquired through the national Marine Fisheries Service.

ISS cooperators collect a tremendous volume of data. This data is requested by other entities in the Salmon and Clearwater drainages including: Idaho Department of Fish and Game regions and headquarters, U.S. Forest Service, Bureau of Land Management, National Marine Fisheries Service, U.S. Fish and Wildlife Service, private landowners, hatchery managers, etc. Many entities rely on the information we collect in making management decisions.

The PIT Tag Information System (PTAGIS), administered by the Pacific States Marine Fisheries Commission, enables and assists us in the use, interrogation, and data base management of Passive Integrated Transponder (PIT) tags.

ISS works closely with the Lower Snake River Compensation Plan (LSRCP) to coordinate on hatchery supplementation treatments.

d. Project history (for ongoing projects)

The Idaho Salmon Supplementation (ISS) Studies in Idaho Rivers project started in 1989 as project 89098, (Idaho Department of Fish and Game, current project 8909800). In 1992, the Nez Perce Tribe, Shoshone-Bannock Tribes, and U.S. Fish and Wildlife Service were funded to assist in the ISS project as cooperative agencies with project numbers of 8909802, 8909803, and 8909801 respectively. The University of Idaho, Idaho Cooperative Fish and Wildlife Research Unit was funded to conduct small scale investigations for the Idaho Department of Fish and Game under the ISS study.

Publications and reports to date include the initial study design (Bowles and Leitzinger 1991), small scale studies (Peery and Bjornn 1996), and annual reports; Arnsberg (1993), Hesse and Arnsberg (1994), Hesse et al. (1995), Keith et al. (1996), Leitzinger et al.(1996), Leitzinger et al. (1993), Nemeth et al. (1996), and Rockhold et al. (1997). A five year summary report encompassing information from all project coordinators is nearing completion (1999).

ISS data addressing current population levels and life history descriptions for many of the chinook salmon (including ESA listed) producing streams in the Salmon and Clearwater drainages is being utilized in the PATH process, hydro-system evaluations, and captive brood programs.

While not directly implemented for ISS, data collected on ISS PIT tagged chinook (wild/natural and hatchery origin) at Snake and Columbia River passage facilities will aid in mainstream smolt monitoring of timing and passage requirements and may contribute to the management/modification of main stem dam operations. Implementation of captive brood programs including: stream prioritization, collection techniques, and monitoring and evaluating techniques will use ISS data.

The ISS study results and recommendations will help guide state, tribal, and federal hatchery programs. For example, brood years 1994 and 1995 chinook salmon were all stocked as smolts, since analysis of 1992-1994 data demonstrated higher minimum rates of detections at main stem fish passage facilities for smolt releases over parr and pre smolt released fish. Population characteristics including historical resiliency to low return years, life history, and genetic descriptions from baseline sampling will also play a vital role in determining which supplementation strategy, if any, produces the best adult-to-adult production without adverse genetic impacts to natural populations.

The IDFG has been funded for 8 years under the project 8909800. During this time our annual budgets have ranged from $850,000 to $1,400,000. The higher budgets were associated with the start-up of the project and included substantial capital acquisitions.

e. Proposal objectives

Objective 1. Monitor and evaluate the effects of supplementation on presmolt and smolt numbers and spawning escapements of naturally produced salmon.

H_{01a}: Supplementation-augmentation of existing chinook populations in Idaho does not affect natural production. Corollary: Rejecting H_{01a} indicated that supplementation can enhance or deter natural production.

H_{01b}: Supplementation-restoration utilizing existing hatchery stocks does not establish natural populations of chinook salmon in Idaho. Corollary: Rejecting H_{01b} indicates that existing hatchery stocks can be used to restore natural populations of chinook salmon in Idaho.

Objective 2. Monitor and evaluate changes in natural productivity and genetic composition of target and adjacent populations following supplementation.

H_{02a}: Supplementation-augmentation of existing chinook populations in Idaho does not reduce productivity of target or adjacent populations below acceptable levels (e.g. replacement). Corollary: Rejecting H_{02a} indicated that supplementation can conversely affect survival and performance of existing populations.

H_{02b}: Supplementation does not lead to self-sustaining populations at some enhanced level (e.g. 50% increase in abundance maintained over time.) Corollary: Rejection of H_{02b} indicates that certain supplementation strategies are successful in establishing self-sustaining populations or enhancing the level at which populations maintain themselves.

Objective 3. Determine which supplementation strategies (brood stock and release stage) provide the quickest and highest response in natural production without adverse effects on productivity.

H_{03a}: Utilization of existing hatchery brood stocks in Idaho is an effective strategy to supplement existing populations of chinook salmon within local or adjacent subbasins. Corollary: Rejection of H_{03a} indicates that development of new supplementation brood stocks for supplementation within the local or adjacent subbasin is needed.

H_{03b}: Development of new, local brood stocks with known natural component for supplementation does not provide an advantage over utilization of existing hatchery brood stocks for supplementation within the local or adjacent subbasin. Corollary: Rejection of H_{03b} indicates that development of new supplementation brood stocks from the target populations can be more successful for supplementation than utilization of existing brood stocks.

H_{03c}: The effects of supplementation on natural production and productivity does not differ among life stages (parr, presmolt, smolt) of hatchery fish released. Corollary: Rejecting H_{03c} indicates which supplementation release strategies (life stages) are most effective (or least deleterious) in rebuilding natural populations.

Objective 4. Develop supplementation recommendations.

f. Methods

A thorough programmatic explanation of the experimental design and methods for analysis is provided in the ISS umbrella proposal as summarized from the Salmon Supplementation Studies in Idaho Rivers (ISS)-Experimental Design (Leitzinger and Bowles 1991). Nineteen treatment and twelve control streams in both the Clearwater and Salmon basins have been divided among four resource management entities for implementation. Each cooperator is responsible for the activities on their respective streams. The Idaho Department of Fish and Game is responsible for ISS project activities in Johns Creek, Crooked River, American River, Red River, White Cap Creek, Crooked Fork Creek, Brushy Fork Creek, Colt Killed Creek, and Big Flat Creek in the Clearwater River drainage, and mid-South Fork Salmon River, Sulphur Creek, Marsh Creek drainage, North Fork Salmon River, Lemhi River, Pahsimeroi River, Upper Salmon River, and Alturas Lake Creek in the Salmon River drainage.

The methods are not described by objective here since all tasks must be completed in synchrony to test the research hypotheses, and each objective tests more than one hypothesis. All tasks listed below must be performed annually to successfully evaluate the production and productivity response variables and to meet the project objectives. The production and productivity response variables measured by performing these tasks are described later in this section. The tasks to be performed in FY2000 are as follows.

Task 1.a Continue to implement "standardized" spawning, rearing, marking, and release protocols for supplementation programs.

Task 1.b Differentially mark all hatchery supplementation and general production fish released in or nearby the study stream.

Task 1.c PIT tag a minimum 700 hatchery supplementation fish prior to release for estimating smolt-to-smolt survival.

Task 1.d Release various life stages of chinook salmon. Determine fish numbers for each life stage based on existing natural production and natural rearing capacity.

Task 1.e Estimate late summer parr densities from snorkeling surveys.

Task 1.f PIT tag a minimum of 700 naturally produced parr from each treatment and control stream to estimate smolt production and survival.

Task 1.g Use existing weirs to collect, PIT tag, and enumerate emigrating fish and to identify and enumerate returning adults.

Task 1.h Compare natural production or supplemented populations to unsupplemented populations and baseline data.

Task 2.a Monitor productivity and genetic indices from supplemented populations and compare to baseline and controls. Productivity characteristics will be evaluated as a function of density or percent carrying capacity to minimize density dependent effects confounding treatment effects.

Task 2.b Monitor straying of hatchery supplementation fish into adjacent and control streams by weirs and carcass surveys.

Task 2.c Determine spawner to recruitment relationship based on determined production and productivity indices (parr and smolt numbers, adult escapements, survival, egg/spawner etc.).

Task 2.d Predict population viability based on spawner-to-recruitment relationship to determine if the population will maintain itself through time in the absence of additional supplementation.

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Task 3.a Monitor and evaluate natural production (pre smolt, smolt, and adult numbers) and productivity (survival, life stage characteristics, pathogens, straying, genetic composition) of supplemented populations and compare to baseline and controls (unsupplemented).

Task 3.b Use local brood stocks with known natural component from the target population during the second generation of supplementation (differentiation of natural and hatchery returns possible through fin clips).

Task 3.c Compare natural production and productivity indices of supplemented populations using existing hatchery brood stocks (first generation) to populations using locally developed brood stocks (second generation).

Task 3.d Compare natural production and productivity indices among supplemented populations using parr, fall presmolt, and smolt release strategies.

Critical Assumptions:

We assume that main stem passage and flow will allow for a net replacement/increase in adult to adult production. Our efforts will be negated without improvements in main stem passage and acceptable water flows.

Description of proposed treatments, methods and evaluation:

Population responses to supplementation will be monitored a minimum of one generation (5 years) following supplementation. The experimental units are the study streams themselves. Final evaluation is ideally dependent on the response of adult escapements to treatments; several interim evaluation points will be useful in indicating initial population responses to test specific hypotheses. The production response variables which we are monitoring include:

Mid-summer parr- 1992-1997 counts of summer parr using snorkeling have resulted in imprecise estimates. Additional effort (e.g. snorkeling a larger percentage of each stream) would be needed to increase this precision, which is not feasible given the numerous other study tasks. Thus, snorkel counts have been temporarily dropped from the study design, but will be added in FY2000 if more precise techniques are developed. A minimum of 500-700 summer parr will be PIT-tagged on each study stream. The tagged parr will be used to estimate survival to Lower Granite Dam.

Fall and spring emigrants (presmolt and smolt)- Juvenile emigration numbers and timing are estimated with out migrant (rotary screw traps) traps. Traps are operated to sample the fall and spring emigration period until icing or water velocity is prohibitive. Capture efficiency is estimated by recapture of marked emigrants released above traps. Capture efficiencies are monitored as a function of stream flow and water temperature. IDFG will operate screw traps on Crooked River, American River, Red River, Crooked Fork Creek, Colt Killed Creek, South Fork Salmon River, Marsh Creek, Lemhi River, and Pahsimeroi River. Incline plane traps will be used on the upper Salmon River.

Smolt production- Survival of smolts reaching Lower Granite Dam will be estimated based on fish PIT-tagged as parr, presmolts, and smolts. Survival of PIT-tagged hatchery smolts to Lower Granite Dam will be compared to naturally produced smolts. Minimum survival estimates of smolts reaching Lower Granite Pool is estimated for all treatment and control streams. Approximately 700 juveniles are PIT tagged prior to or during emigration from the study streams and hatcheries. A similar number of hatchery fish are PIT tagged prior to release into treatment streams.

Adult escapement- Escapement to Crooked River, Red River, Crooked Fork (including Brushy Fork) Creek, South Fork Salmon River, Lemhi River, Pahsimeroi River, and upper Salmon River is determined by adult weirs. Aerial and ground counts are used to estimate adult escapement on the other study streams, as well as most of the streams with weirs. Potential egg deposition is estimated based on fecundities of females taken into the hatchery nearest each study stream.

In addition to the above production response variables, we are evaluating the following productivity response variables:

Survival - Natural production estimates for the production response evaluation points will be used to estimate survival relationships for up to eight life stage intervals. Redd (egg)-to-parr, parr-to-smolt (at Lower Granite Pool), smolt-to-redd, and redd-to-redd survival rates will be estimated for all treatment and control popuilations. The survival relationships will be estimated as a function of fish numbers or density.

In-hatchery survival relationships will be monitored for egg-to-fry, fry-to-fall presmolt, and fall presmolt-to-release intervals. These survival rates will be measured as a function of density but are assumed to be predominately limited by density independent factors up to the hatchery capacities.

Fecundity - Fecundity schedules, by age and length, will be as measured from hatchery and natural fish collected for each supplementation brood stock and pooled across years within generations. Supplementation effects will be measured as trends in these fecundity schedules. Fecundity will not be monitored directly for populations in control streams.

Age structure - Age at return for adult male and female chinook will be determined from scales and coded-wire tags recovered from carcasses surveyed in natural spawning areas and from adults returning to weirs.

Spawning distribution - Temporal and spatial distribution of spawning will be monitored in all treatment and control streams. Run timing will be quantified directly for streams with weirs and qualitatively for study streams without weirs. Spatial distribution of spawning will be monitored by peak redd counts (ground or aerial) conducted throughout the entire study stream.

Spawning ratio - The spawning ratio will be monitored for all treatment streams. The ratio will be determined by counting marked (supplementation) v.s. unmarked (natural) adult returns at weirs followed by ground carcass surveys to estimate egg retention and prespawning mortality. This information will be analyzed directly or as a covariate to indicate spawning success and progeny survival associated with various proportions of hatchery and natural spawners.

Emigration timing - Emigration timing will be monitored for study streams with weirs and juvenile traps. This information will be used to indicate shifts in the proportion of fall and spring emigrants, and the temporal distribution of emigration within each season.

Genetic composition - Genetic structure and variability will be monitored for natural and hatchery populations associated with our research. Allelic frequencies will be monitored through starch gel electrophoresis. All inferences from genetic data will incorporate other ecological (i.e. life history, health, behavior, abundance) and environmental (i.e. carrying capacity, temperature, flows, habitat) data. This information will provide a valuable tool to assess supplementation risk and track potential genetic impacts of supplementation on long term population fitness.

Potential Risks:

The risks associated with ISS were evaluated under the 1991 draft RASP criteria.
ISS treatment streams already have ongoing hatchery programs. Consequently, ISS hatchery protocol should pose minimal ecological risk, if any, to the chinook salmon populations in these streams. Risks are primarily associated with not conducting ISS, and failing to identify and implement the best recovery measures resulting in the continued decline or extinction of the population and adversely impacting wild\natural populations through the use of inappropriate supplementation due to lack of information. The use of out-migrant traps and adult weirs impose a limited risk to individual animals in term of direct mortality and migration alteration.

Justification of Sample Size for Juvenile PIT-tagging:

Sample size requirements for determination of survival to Lower Granite Dam are estimated using the SURPH.1 (Smith et al. 1994) SAMPLE_SIZE program. Desired precision levels are established as 95% confidence intervals within $\pm$5% of the survival estimate. Using observed survival and detection probability rates from recent hatchery releases within the Snake River basin estimated minimum release groups of 800 smolts (or smolt equivalents) will be required. Sample sizes to obtain juvenile life history (timing and distribution) data are based on obtaining 50 (30 minimum) individual observations at Lower Granite Dam.

Methods for data analysis:

The methods for data analysis is covered in the ISS umbrella proposal. The Experimental Design also outlines statistical procedures to be used in data analysis. If substantive changes are made to the Experimental Design in the future, new statistical methods will be prescribed. Supplementation effects will be evaluated using repeated measures profile analysis (split plot through time) to test the response of populations to treatments over time as compared to untreated streams. To help partition variability, some hypotheses utilize a block design. Depending upon the specific hypothesis, blocks may include status of existing population, brood source, life stage out planted, and stream productivity.

Expected Results:

We expect this research to document the best method for supplementing existing naturally reproducing populations of chinook salmon and the best method for re-establishing naturally producing populations in streams where chinook have become extirpated. Because study streams have different ecological characteristics, supplementation effects and recommendations will likely be vary among streams.

g. Facilities and equipment

Brood stock collection and juvenile production of chinook salmon for supplementation of treatment streams uses existing hatcheries in Idaho. Treatments do not require additional production, but are coordinated with ongoing hatchery production. Costs associated with production of supplementation fish are covered under individual hatchery budgets.

IDFG facilities are adequate for this project. IDFG personnel participating in this project are stationed and the IDFG Nampa Research Office and at IDFG Regional Offices in Lewiston, McCall, and Salmon, Idaho. The project utilizes existing hatchery facilities in the state (Sawtooth, Pahsimeroi, McCall, Rapid river, Clearwater Anadromous). All major equipment needed has been purchased through previous contracts for the project. Equipment on hand includes, but is not limited to, 9 vehicles, 9 juvenile screw traps, 5 PIT-tag stations, field computers for PIT-tag stations, office computers, printers, photocopiers, other field equipment including nets, seines, wet suits, trailers for field lodging, and camping gear for remote field work. Equipment is stored in a separate storage building at the Nampa Research Office.

h. Budget

A small increase, over the FY1999 budget amount, is included in the FY2000 personnel costs to cover salary increases. Personnel covered by this project include 5.17 permanents and 9.83 temporaries.

The operations and maintenance costs include the costs of providing office space for project and personnel and the extensive field season (March-November), geographic scope, and equipment associated with the project.

Capital acquisitions in FY2000 include the replacement of two project vehicles each with >130,000 miles and purchase of a Coded-wire-tag wand detector for detecting supplementation marked fish in the field.

Inderct costs are set by the IDFG and are estimated to be 23% in FY2000.

Section 9. Key personnel

The project Principal Investigator is Peter Hassemer, Principal Fisheries Research Biologist. He has worked for the IDFG since 1990, two years in fisheries management and seven years in anadromous fisheries research. His primary areas of responsibility are oversight of the Department's anadromous hatchery evaluation program, chinook salmon supplementation research, and co-management of the chinook captive rearing program. He received a B.S. (1979) and M.S. (1984) in Fisheries Science from the University of Idaho.

Jody Walters: B.S. (Biology) University of Wisconsin-Stevens Point (1986), M.S. (Zoology) University of Arkansas (1993). Work experience has included two years with the Wisconsin Department of Natural Resources (WDNR)-Bureau of Fisheries Research, one year with WDNR as an Assistant Fish Manager, four years with the Arizona Game and Fish Department as a Fishery Research Biologist, and (currently) over a year with IDFG as a Fishery Research Biologist.

Brian Leth is a Senior Fisheries Technician on the project. Brian graduated from the University of Idaho in the spring of 1994 with a B.S. in Fisheries Resource Management. He has been with the Idaho Department of Fisha nd Game since the spring of 1992 working on anadromous fisheries research projects. He has spent most of his time with the Department operating and maintaining fish trapping facilities. He has PIT-tagged thousands of juvenile salmon and steelhead and has been involved in collecting biological samples from adult salmon and steelhead.

Section 10. Information/technology transfer

Technical information is distributed through annual progress reports for individual study sites. A five year progress report including information from all project coordinators has been completed. In 2007, a final project report will be completed. Project cooperators meet regularly to exchange information and discuss project adaptations.

ISS cooperators collect a large volume of data, and much of it is requested by numerous entities in the Salmon and Clearwater drainages including: Idaho Fish and Game regions/headquarters, US Forest Service, Bureau of Land Management, National Marine Fisheries Service, US Fish and Wildlife Service, private landowners, hatchery managers, etc. Many entities rely on the information we collect in making management decisions. There is a tremendous amount of information transfer between ISS and entities.

Congratulations!